National Institute of Environmental Health Sciences

Current and future climate- and air pollution-mediated impacts on human health

Author(s): Doherty RM, Heal MR, Wilkinson P, Pattenden S, Vieno M, Armstrong B, Atkinson R, Chalabi Z, Kovats S, Milojevic A, Stevenson DS

Year: 2009

Journal: Environmental Health : A Global Access Science Source. 8 (Suppl 1): S8

Abstract:

BACKGROUND: We describe a project to quantify the burden of heat and ozone on mortality in the UK, both for the present-day and under future emission scenarios. METHODS: Mortality burdens attributable to heat and ozone exposure are estimated by combination of climate-chemistry modelling and epidemiological risk assessment. Weather forecasting models (WRF) are used to simulate the driving meteorology for the EMEP4UK chemistry transport model at 5 km by 5 km horizontal resolution across the UK; the coupled WRF-EMEP4UK model is used to simulate daily surface temperature and ozone concentrations for the years 2003, 2005 and 2006, and for future emission scenarios. The outputs of these models are combined with evidence on the ozone-mortality and heat-mortality relationships derived from epidemiological analyses (time series regressions) of daily mortality in 15 UK conurbations, 1993-2003, to quantify present-day health burdens. RESULTS: During the August 2003 heatwave period, elevated ozone concentrations > 200 microg m-3 were measured at sites in London and elsewhere. This and other ozone photochemical episodes cause breaches of the UK air quality objective for ozone. Simulations performed with WRF-EMEP4UK reproduce the August 2003 heatwave temperatures and ozone concentrations. There remains day-to-day variability in the high ozone concentrations during the heatwave period, which on some days may be explained by ozone import from the European continent.Preliminary calculations using extended time series of spatially-resolved WRF-EMEP4UK model output suggest that in the summers (May to September) of 2003, 2005 & 2006 over 6000 deaths were attributable to ozone and around 5000 to heat in England and Wales. The regional variation in these deaths appears greater for heat-related than for ozone-related burdens.Changes in UK health burdens due to a range of future emission scenarios will be quantified. These future emissions scenarios span a range of possible futures from assuming current air quality legislation is fully implemented, to a more optimistic case with maximum feasible reductions, through to a more pessimistic case with continued strong economic growth and minimal implementation of air quality legislation. CONCLUSION: Elevated surface ozone concentrations during the 2003 heatwave period led to exceedences of the current UK air quality objective standards. A coupled climate-chemistry model is able to reproduce these temperature and ozone extremes. By combining model simulations of surface temperature and ozone with ozone-heat-mortality relationships derived from an epidemiological regression model, we estimate present-day and future health burdens across the UK. Future air quality legislation may need to consider the risk of increases in future heatwaves.

Source: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2796504

Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Special Report on Emissions Scenarios (SRES), Other Climate Scenario

Special Report on Emissions Scenarios (SRES) Scenario: SRES A2

Other Climate Scenario: calculating maximum feasible reductions (MFR) in the future (optimistic); assuming current legislation (CLE) and air quality standards apply in the future

Exposure :

weather or climate related pathway by which climate change affects health

Air Pollution, Temperature

Air Pollution: Ozone

Temperature: Extreme Heat

Geographic Feature:

resource focuses on specific type of geography

Rural, Urban

Geographic Location:

resource focuses on specific location

Non-United States

Non-United States: Europe

European Region/Country: European Country

Other European Country : United Kingdom

Health Impact:

specification of health effect or disease related to climate change exposure

Morbidity/Mortality

Model/Methodology:

type of model used or methodology development is a focus of resource

Exposure Change Prediction, Outcome Change Prediction

Resource Type:

format or standard characteristic of resource

Research Article

Timescale:

time period studied

Medium-Term (10-50 years)